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Dairy Cattle: ACQUITTED Page 3

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The Best, Better

June is Dairy Month—an appropriate time to announce that agricultural researchers have disproved earlier studies that cited milk as a cause of goiter in humans (page 3, this issue).

Dairy cows were accused—and falsely so—in the middle 1950's of giving goiter-causing milk after having consumed plants from the mustard family. Now, Finnish scientists, working under a PL–480 grant, have established that it is not possible for a cow to eat enough of these plants to cause her milk to hinder the uptake of iodine and thereby induce goiter.

But this acquittal, important as it is, could not have taken place were it not for inquisitive scientific minds, often stimulated into action by farmers themselves.

If you doubt this fact, visit one of today's Grade A dairy barns and witness the change during the last decade. Study feed and its handling, for example. Grain that a decade ago was fed by pail or scoopful is today, more often than not, fed in a carefully prepared diet conveyed automatically to cows in exact metered amounts.

Even so, the dairyman asks: Is this the best feed or am I just assuming it to be? Scientists respond with a question of their own: What do we REALLY know about how a dairy cow utilizes feed?

For the answer to this basic question, scientists at Beltsville have enclosed "Lorna," a Holstein cow, in a comfortable plastic chamber where all of her intake and output can be measured (page 16, this issue). The objective: To gain knowledge that will lead to improved feeding, breeding, and management.

Questions like these are being asked also in other areas of farming. For example, can we improve on tools we use to plant corn? Beginning with the soil, researchers are studying tillage-induced differences in soil properties to find the ideal corn seedbed (page 8, this issue). Armed with this knowledge, they can then design tillage practices that will create the optimum seedbed conditions.

Because of this constant questioning and evaluation—between farm and laboratory—scientists are able to speed research that benefits both producers and consumers of food and other farm products.

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Dairy Cattle: ACQUITTED

Research disputes belief that milk can cause goiter

■ The gentle cow stood accused. She was charged with giving milk that caused goiter in human beings—when she ate plants of the mustard family. It was up to a group of Finnish scientists to give her a fair trial.

Her strongest accusers were two Australian scientists, who, in 1956, presented the hypothesis that milk from cows fed on forage or fodder of the mustard family caused goiter in persons who drank it.

There was much thought behind their hypothesis. Since 1928, scientists in several different countries had been saying that animals fed on a diet of mustard-family plants developed goiter. Somewhere along the line the theory developed that the plants contained substances that caused goiter by keeping the thyroid gland from taking up its normal amount of iodine. In 1949, three Finnish scientists isolated the iodine-inhibiting substances in some mustard-family plants and identified them as L-5-vinyl-2-thiooxazolidone (VTO) and thiocyanate (SCN).

The reasoning behind Old Bossy's accusation was this: Man drinks the milk given by cows fed on different mustard-type plants. The goiter-causing substances in the plants can be transferred to man through milk from cows fed on the plants. The two Australian scientists presented this evidence in their 1956 accusation.

That is why, in 1958, ARS awarded the Biochemical Institute in Helsinki, Finland, a Public Law 480 grant to get the facts behind the accusation. After all, milk is included in school lunches throughout the world.

Under Public Law 480, the United States sells surplus agricultural products to some foreign countries and is paid in the countries' own currencies. These foreign currencies cannot be converted into dollars for use in the United States, but a portion of the money can be used to pay for foreign research that will benefit U.S. agriculture. Milk is important to the economy and health of many countries. Finland was anxious to take the cow's case, as goiter is prevalent in many areas of that country.

The cow was subjected to all kinds of indignities during the trial. She was fed diets alternately heavy in kale, rape, turnips, and cabbage. She was stuffed on crystalline VTO. She was given another diet of pure starch, suc-

rose, sulphite cellulose, maize oil, ammonium sulphate, and phosphate. She was fed at irregular hours and at regular intervals ranging from 1 to 24 hours. The food was taken from her rumen and examined for SCN and VTO. It was also taken from her mouth after she had chewed it. Blood was taken from her veins and examined for the compounds. And she was milked at the oddest times, both day and night.

The Finnish scientists, headed by Finland's Nobel prize winner A. I. Virtaner, found that sure enough the formation of VTO and SCN did take place in the mouth and rumen of the cow when she chewed mustard-family plants. Since this was true, it was conceivable that the compounds might pass from the rumen into the blood and from there to the milk. The scientists tested the milk and compared the amounts of SCN and VTO it contained with the amounts in the crushed plants. They compared the amounts in the milk with the amounts of the compounds their experiments had determined necessary to prevent the uptake of iodine in human beings.

They found that it was impossible for a cow to eat enough of the plants to cause her milk to hinder the uptake of iodine in humans and cause goiter.

But they still had to put two and two together. So they performed tests with 22 volunteers—7 women and 15 men. Shortly after taking iodine 131, each person drank, on an empty stomach each morning for 25 mornings, two quarts of milk from cows fed on various mustard-family diets. The uptake of iodine was not in any way affected by drinking milk from the cows on this diet. Milk from cows fed on a diet lacking mustard-family plants was used as the control.

To check whether the method used for measuring the uptake of the iodine was sensitive enough, the scientists had the volunteers take doses of VTO and SCN about 3 hours after no effect of the milk could be shown. Iodine uptake was then strongly checked.

These numerous tests proved that the hypothesis was wrong. Neither milk produced by cattle on an extremely high mustard-family diet nor milk produced on an ordinary diet could be shown to disturb the accumulation of iodine in the thyroid gland of man.

To make doubly sure and to check on the remote possibility that some other factor—something that was not in mustard-family plants — could cause goiter, the Finnish scientists performed tests with female rats—80 of them for 350 days. Different groups of rats were fed on milk produced on many different feeds, including mustard-family plants, and not the slightest indication of any goiter-causing substance was obtained.

So after these 5 years of experiments, the Finnish scientists have acquitted Old Bossy. And the gentle cow goes on chewing her cud.☆

Cotton Seedling Disease...

Incidence increases as temperature falls, sugar content rises

■ Research by scientists at Stillwater, Okla., may explain why cotton seedling disease is generally more severe in cool weather.

Young cotton plants subjected to relatively low temperatures had increased sugar content, followed by a significant rise in the incidence of disease.

ARS plant physiologist Gene Guinn and plant pathologist R. E. Hunter, working in cooperation with the Oklahoma Agricultural Experiment Station, revealed the apparent interrelationships that exist between temperature, sugar, and disease.

The scientists found that the sugar content of cotton seedlings rose sharply when the temperature was lowered from 81° to 61° F. The sugars dropped back to original concentrations when the temperature was returned to 81°.

Guinn and Hunter also noted that pulverized tissue from the chilled cotton seedling stems supported nearly twice as much growth of the seedling disease fungus *Rhizoctonia solani* as tissue from unchilled plants. This disease, which is called damping off, causes the seedlings to rot and die.

Chilling the tops of the cotton plants had little effect on sugar content if the roots were kept warm. But chilling the entire seedlings caused rapid increases in sugars throughout the plants, the greatest increases occurring in the stems. This biological change apparently promoted the development of disease organisms in the seedlings.

The scientists plan further research to learn more about the effects of chilling on sugar content and disease development in young cotton plants.☆

Aluminum Repels Aphids

Tests show that 96 to 98 percent of aphids avoid metal-protected plants

Aphids spread mosaic cucumber virus to gladiolus plants, causing a symptom called flower breakage seen in spike at right. Healthy spike is at left.

Reflective aluminum may become a weapon against disease-carrying aphids.

ARS and Cornell University scientists used aluminum sheets (foil) and nontoxic aluminum sprays to divert aphids from plants grown in test plots at Beltsville, Md., and Farmingdale, N.Y., in 1963.

These materials are experimental only; they are not recommended for use by growers.

F. F. Smith, G. V. Johnson, and S. W. Jacklin, ARS entomologists, R. P. Kahn, ARS plant pathologist, and Arthur Bing, Cornell University horticulturist, are cooperating in the research. Tests were made on gladioluses at Farmingdale and on *Vernonia anthelmintica* (indian ironweed) at Beltsville. Indian ironweed is a potential oilseed crop being studied for materials used in plastics, paints, and other products.

Scientists have not yet determined why aluminum repels aphids, and they still must learn whether other important virus vectors might exist that are not repelled by aluminum.

Winged aphids move rapidly from one plant to another in search of food. Some of them transmit viruses.

When aluminum sheets were placed between plant rows and around borders of plots, the number of aphids caught in traps was reduced 96 percent at Farmingdale and 98 percent at Beltsville.

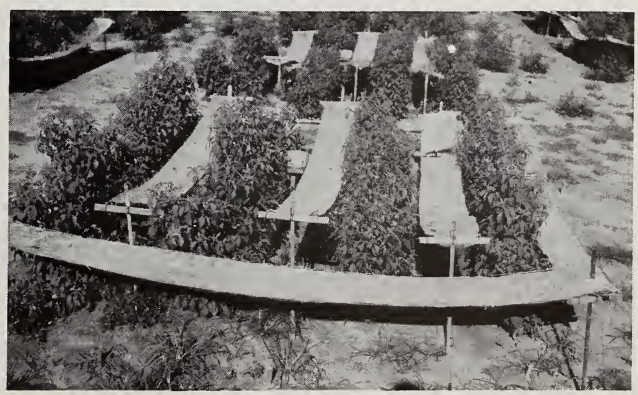
While they lasted, aluminum sprays on the plants were about as effective as aluminum sheets in repelling aphids, but the formulations evaluated did not adhere to plants more than 2 or 3 days.

In test plots this year, the scientists are spraying a mixture of aluminum powder and asphalt paint in a band on the soil between rows of plants. Both materials are nontoxic to plants and animals. By incorporating an aluminum powder in the asphalt spray, the scientists hope to combine in a single treatment the insect repellency and mulching quality of aluminum with the adhesiveness and mulching characteristics of asphalt spray. Asphalt preparations have been used in sprays to promote rapid sprouting of seeds and earlier crop maturity.

The scientists hope also to develop an economical aluminum spray that adheres well to foliage. They plan to investigate the effect that aluminum ground and foliage sprays have on the growth rate and yield of treated plants. They will also compare the use of sprays with aluminum sheets between rows and around borders of experimental plots.

Gladioluses are being used in tests again this year at Farmingdale; indian ironweed is being replaced with several other plants at Beltsville.☆

Sheets of aluminum foil between rows and around borders keep aphids out of Vernonia anthelmintica (*indian ironweed*) *in test plots at Beltsville, Md.*



Precise control with a ground unit that . . .

TREATS 60 ACRES AN HOUR

A self-propelled spray rig that permits precise control in treating 60 to 100 acres an hour has been built by ARS researchers at the U.S. Southern Great Plains Field Station, Woodward, Okla.

The unit, built around a chassis from a self-propelled combine, was designed by C. G. Armstrong, agricultural research technician, E. H. McIlvain, station superintendent, and M. R. Gebhardt, agricultural engineer stationed at Columbia, Mo. The work was done in cooperation with the Oklahoma and Missouri Agricultural Experiment Stations.

The spray rig was created especially for the Great Plains, but it could easily be used on any terrain that is relatively flat or smooth. The sprayer is particularly well suited for use where low-cost, rapid coverage of large acreages is needed. Operating cost—excluding the chemicals—is about 28 cents an acre.

Besides the combine chassis, on which is mounted a 340-gallon tank, the unit includes a lifting mechanism for the cable-supported booms and their fluid lines and nozzles. Airplane wheels and tires provide good traction and make the sprayer less tiresome to ride than a large farm tractor, Armstrong says.

When extended, the spray booms span 100 feet; when the booms are in folded position, the entire unit is only 10 feet wide. Boom ends can be raised or lowered hydraulically to prevent them from striking the ground on uneven terrain.

Inside the tank, a 12-inch outboard motor propeller keeps the emulsion of oil, water, and chemical well mixed.

The chemicals are strained four times before they reach the crop. The first strainer consists of a 4-inch pipe with quarter-inch holes and covered with heavy-duty cotton. The second is a commercial gasoline strainer with a 50-mesh screen, and the third is a strainer with a 100-mesh screen. Finally, the chemical passes through 100-mesh screens in each nozzle.

Fifty nozzles along the fluid line can be interchanged to permit extremely precise applications of spray varying from 40 gallons down to as little as 1.5 gallons per acre. Narrow strips of land can be sprayed by turning off part of the fluid line.

The long-boom sprayer was used to treat some 2,000 acres of rangeland in 1962 and 1963. Armstrong says it climbed dunes easily and was very stable on moderate slopes.

In addition to being useful for large acreages, Armstrong says the sprayer can be used to supplement aerial spraying of small acreages. It is also useful on slightly windy days when aerial spraying could be hazardous.☆

Self-propelled spray rig—with 100-foot boom span—covers ground rapidly and applies liquid fertilizers or chemicals in precise amounts. With booms in folded position, unit is only 10 feet wide.

The fungus inhibited these smooth brome grass seeds and seedlings to varying degrees. The effects appears as dark hornlike synemmata, somewhat resembling discolored roots.

Grassland Inhibitor

Soil-born fungus hampers seedings of range grasses in Western States

■ A previously unsuspected enemy of western range grasses has been identified—and, already, a possible control found.

The enemy is a soil-borne fungus, *Podosporiella verticillata* which also affects cereal grains. And the promising control measure is seed treatment with the fungicide captan.

Identification of this fungus infection is particularly important because its control may help western ranchers get improved stands of grass following seeding. Survival rates now are often well under 10 percent.

Research has shown the fungus capable of infecting seeds and seedlings of many grasses common to ranges in the Western United States and in Western Canada and Mexico. Plant pathologist K. W. Kreitlow and range conservationist A. T. Bleak, both of ARS, are conducting the research in cooperation with the Utah Agricultural Experiment Station.

Preliminary tests indicate that treating the grass seed with captan, a commonly used fungicide, provides effective control of the fungus infection without reducing seed germination. Further tests are being made to confirm this finding.

To learn what happens to grass seeds sown in rangelands, Bleak used a simple, effective method of recovering seeds he had sown by enclosing them in nylon mesh strips. The nylon had openings smaller than the seeds but large enough to allow sprouting.

Many of the seeds in the test strips were discolored and failed to germinate. Others appeared to germinate but either failed to produce seedlings or the seedlings were weak. On examining the affected seeds, Kreitlow found that a high percentage of the discolored seeds was infected with a rather unusual fungus.

Kreitlow and Bleak believe that *P. verticillata* is a more serious pathogen on grasses than anyone had previously realized, even though the fungus was identified as a wheat pathogen about 50 years ago.

They have already found numerous grasses susceptible to infection by the fungus—including crested, slender, fairway, and intermediate wheat grasses, smooth and mountain brome, and cheat-grass. Among cereal grains, barley, rye, and wheat are susceptible. Wild oats and Rambler alfalfa have resisted infection thus far.

In their studies, which extended from 1958 through 1962, test seed was sown on various sites in central and northern Utah at three elevations—sagebrush sites ranging from 4,500 to 6,500 feet; mountain brush sites, 6,500 to 7,800 feet; and aspen-fir sites, 7,800 to 9,000 feet.

The seed was sown between mid-September and late December, and seed strips were recovered from the soil 1 to 7 months after planting.

Infection was most serious in the lower, sage-brush elevation and decreased as elevation increased. It tended to decrease also as the sowing extended into the fall. The infection occurred earliest in the most susceptible grass species, but within 2 months recognizable infection could be found in most of the species tested. Maximum infection was found in seeds examined during the succeeding March, April, and May.

Of the species tested, smooth brome was consistently the most susceptible to infection by *P. verticillata*, having an average infection rate of 74.7 percent for a 2-year period. Crested, fairway, and intermediate wheatgrasses, along with wheat, comprised a group that was moderately susceptible to the fungus. Mountain brome was slightly susceptible, and slender wheat and barley, least susceptible.

The grass species had the same degree of susceptibility under laboratory conditions as they were found to have in the field tests.☆

To aid tillage, scientists determine optimum conditions in . . .

Corn Seedbeds

Two preliminary findings by ARS soil scientists emphasize how small variations in the physical condition of the soil can markedly affect the growth rate of young corn plants:

- A difference of four degrees (70° F. instead of 66° F.) in the average soil temperature at 4-inch depth doubled the top growth of 6-week-old corn plants.
- An increase of less than 3 millimeters in the average diameter of soil aggregates (conglomerates of fine soil particles) reduced the height of 19-day-old corn plants by about a fifth.

The scientists also devised, for the first time, an accurate method that can be used in measuring the porosity of freshly plowed soil.

These findings are part of research on *all* tillage-induced differences in soil physical properties by scientists at the North Central Soil Conservation Field Station, Morris, Minn. Cooperating with the Minnesota Agricultural Experiment Station, R. R. Allmaras, R. E. Burwell, and W. B. Voorhees are investigating the influence of these differences on the early growth of corn.

Their research is a step toward new corn tillage methods designed to create optimum conditions in and between crop rows. Much previous research dealt with the capabilities of various tillage machines; the ideal growing conditions had not been defined.

The Minnesota research is an extension of the new approach to corn tillage suggested by ARS soil scientist W. E. Larson (Agr. Res., July 1962, p. 6). Larson pointed out that row-crop fields should be managed as two distinct zones—the crop rows and the space between the rows. Creating a favorable environment for the plants is paramount in the crop rows, while conserving soil and managing water effectively should be the objective between rows.

In field plots near Morris, Lamberton, and Crookston, Minn., and Madison, S. Dak., Allmaras leads research in studying the physical conditions produced by conventional tillage and two variations of minimum tillage. They are concentrating on the period

ARS soil scientist R. E. Burwell demonstrates a microrelief meter for measuring surface roughness on a 40- by 40-inch plot of freshly plowed soil. Bottoms of rods touch soil surface at 2-inch intervals; tops of rods reproduce soil profile on graduated chart.

from planting until the corn is 2½ feet high, because tillage-caused changes tend to decrease later in the growing season.

The soil scientists are giving special attention to soil temperature, soil aggregate size and arrangement in the crop row, and total porosity and surface roughness between the rows.

What are the practical advantages?

Increasing early-season soil temperature is potentially beneficial where 4-inch soil readings are usually well below 81° F., the optimum for early corn growth. Although field practices usually change soil temperatures no more than a few degrees, Allmaras says a small increase would be particularly valuable in the northern part of the Corn Belt.

The size of soil aggregates and the ability of the soil to take up and hold moisture are directly related, Voorhees points out. The openings or pores between the aggregates are large when average aggregate size is large, small when aggregates are small.

Small pores, those that hold moisture within immediate reach of seedling roots, are desired in the seedling zone.

In the zone between the rows, the soil should be managed to produce a desired surface roughness and porosity. The effect of opening and "fluffing" the soil by tillage is readily apparent at the edge of a recently plowed strip, where the surface of the plowed area may be 2 inches above the adjacent unplowed surface.

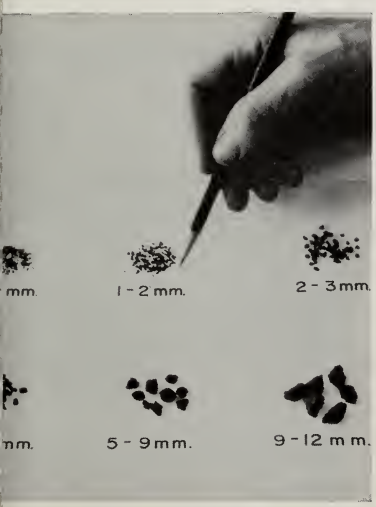
The roughened surface has twin advantages for increasing water intake. The surface depressions temporarily detain water otherwise lost as runoff. And the uneven surface is less likely to become puddled and nearly impervious to further moisture penetration during heavy rains.

Increasing soil air space by tillage is closely akin to increasing soil aggregate size; both increase the infiltration rate.

Burwell is measuring surface toughness before and after tillage, using 3-inch undisturbed soil cores for the pretillage measurements. For post-tillage readings, a unique device called a microrelief meter was devised by the Morris scientists in 1961. This microrelief meter gives 400 elevation readings on the roughened soil in a 40- by 40-inch area.

Previous research, conducted primarily in greenhouses and on small plots, demonstrated the potential importance of soil physical condition on early growth of corn. The current field tests should indicate the range and effect of tillage-induced differences under a wide variety of conditions.☆

LEFT—The size of soil aggregates from freshly plowed soil were studied in relationship to the growth of corn. RIGHT—Soil samples were taken just before corn was planted and at intervals until corn was about 2½ feet high.



WOOL MEETS MODERN NEEDS

Continuing changes are being made in a product that is as old as history

A decade ago, wool that could be washed in a machine without shrinking was little more than a desire. So were stretchable wool and wool with permanent creases and pleats.

Today, at least three garment manufacturers are turning out shrinkproof wool apparel, others are making stretch-wool suits, and the U.S. Quartermaster Corps has approved wool uniforms with permanent creases and pleats for the Armed Forces.

Tomorrow's garments, because of today's research, will be made of improved all-wool stretch fabric—wool that has better mothproofing—wool that resists soiling—and wool that wears longer.

These continuing changes—in a product as old as history—are being brought about by the wool industry and by scientists at the Western utilization research laboratory, Albany, Calif. It was at Albany, for example, that machine-washable wool had its beginning.

ARS chemists credit a bit of chemical magic known as the "nylon rope trick" for suggesting the process for making wool machine washable.

When chemists demonstrate the "rope trick," they place two non-mixing solutions in a beaker. One contains an amine, the other an acid chloride. The two react at the area of contact, creating a substance that the chemical "magician" can draw out of the beaker in the form of a thin wet strand or "rope."

The "rope" actually is a kind of nylon. It is composed of very large, densely bonded molecules and is called a polyamid.

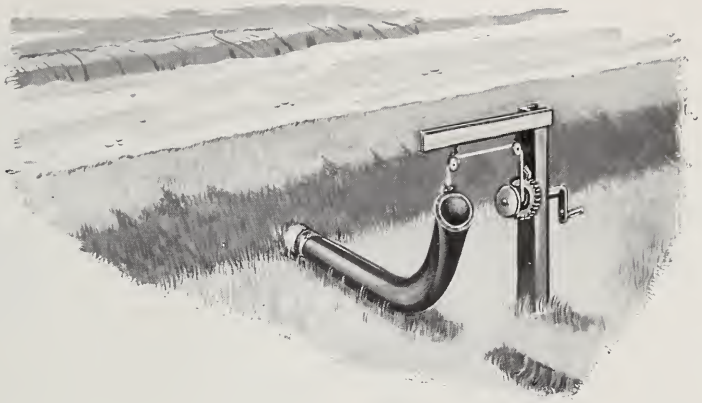
Men's shrinkproof wool shirts—that can be machine washed—are now on the market.

The ARS process for shrinkproofing wool applies the polyamid principle in two steps. Fabric is dipped in amine solution, squeezed, dipped in acid chloride solution, and squeezed again. This results in a very thin polyamid coating, chemically grafted to the fibers by the reaction that occurs when one solution contacts the other.

This coating modifies fiber surfaces enough to reduce the fibers' tendency to tangle and mesh ("felt"), as well as to minimize shrinkage during turbulent washing. It adds little weight to the fabric—about 1 percent.

Treated fabric retains all the comfort, warmth, and beauty of untreated wool. But it makes into easy-care garments that can be machine washed and that need only slight pressing afterwards.

Research at the Western laboratory has perfected a commercially practical system for shrinkproofing wool "top" (wool fibers before they are spun into yarn), using the polyamid principle. And three U.S. firms are now producing interfacially polymerized yarn under an ARS public service patent. The shrinkproof yarn is going into machine-washable knit goods.☆



L-Metergate

Flexible tubing provides efficient way to divert, measure irrigation water

■ A length of flexible plastic tubing and related fittings, in the ingenious hands of ARS soil scientist C. W. Lauritzen, have been fashioned into an efficient device for diverting and measuring the amount of irrigation water applied to fields.

Lauritzen developed the device, which he terms an L-metergate, in cooperation with the Utah Agricultural Experiment Station at Logan.

The experimental L-metergate has the advantages of being leakfree, low cost, and easily installed and operated. Conventional turnouts, or lateral headgates, are relatively watertight when new, but they are easily damaged in closing and often become leaky.

Flow of water is controlled by raising or lowering the end of flexible plastic tubing with ratchet device (see sketch).

Because irrigation accounts for 46 percent of all water diverted from the Nation's rivers and streams, prevention of waste by irrigators is tremendously important in conserving water. Farmers consequently need accurate methods of measuring the amount of water applied to fields to avoid waste by overirrigation.

Metergate is easy to install

To build the L-metergate, Lauritzen first placed a pipe through the bank of the supply ditch that brings irrigation water to a field ditch. He clamped a length of tubing to the field side of the pipe and installed a metal ring on the open end of the tubing. A cord on the ring passes over pulleys on an L-shaped bracket and wraps around a wheel locked in place by a ratchet device (see sketch).

Cranking the ratchet wheel controls the flow of water through the metergate: lowering the free end of the tube opens the gate, and raising it closes the gate. The distance the tube end is raised above the ground surface regulates the amount of flow.

The flexible tube is made of butyl-coated nylon fabric, formed into "lay-flat tubing," which is frequently used for conveying or distributing irrigation water. This material is strong and highly resistant to biological deterioration. Similar material has been exposed to weathering in contact with the ground since 1947 without significant change in properties.

Research will calibrate flow

Lauritzen says additional research is needed to calibrate water flow through the gate at various openings under a standard set of installation conditions. Preliminary tests indicated that discharge is influenced by the length of tubing used.

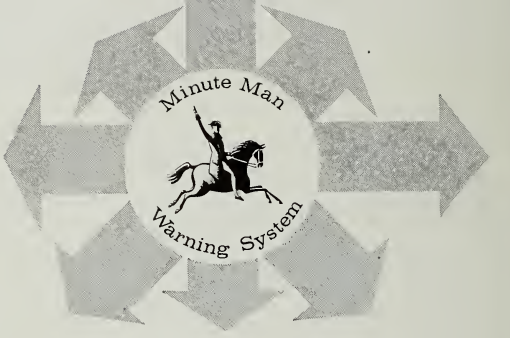
The scientist also used lay-flat tubing in designing a similar turnout structure for diverting irrigation water from a supply ditch serving individual fields. In this installation, the flexible tubing is attached at an opening in a canvas dam that closes the field ditch.

To close this gate, the operator lifts the tube and lays it over the wooden or metal bar supporting the canvas dam. To open the turnout, he lifts the tube from the bar and allows it to rest on the ground. Measuring the amount of water at this point is unnecessary if a metergate is installed at the ditch entrance to a field.

Turnout structures of flexible tubing are easily installed and opened, completely watertight when closed, and quickly removed when a ditcher is used to clean the supply ditch.☆

Today's Minute Men

Fight Hog Cholera



■ In 1776, Minute Men fought the British. Today, they're fighting a different foe—hog cholera.

The strategy in both cases is the same: Warn the neighborhood that danger is near. Today's cholera-fighting Minute Men do this by alerting all farmers in the area surrounding an outbreak so that they take precautionary measures against the disease.

The modern-day Minute Man originated in Iowa, but a number of other States also have warning systems in effect.

Is the system working? Iowa's figures indicate that it is. That State had 429 outbreaks of cholera reported in 1962, only 266 last year. Veterinary officials point out, of course, that the Minute Man warning system can't be given all the credit. But they do feel that it was a valuable aid in reducing the incidence of hog cholera.

Four phase program initiated

The Minute Man warning system is only one of the weapons being used in an all-out war that's now being waged to eradicate hog cholera. The cooperative State-Federal hog cholera eradication effort got underway in December 1962 when standards for a four-phase program were developed and adopted by State and ARS animal disease control officials. Forty-two States and Puerto Rico had entered the program by April 1, 1964, and three States had already progressed to the final phase.

During 1963, the first complete year of program activity, there were 1,550 outbreaks of hog cholera reported to USDA. This compares with 2,912 outbreaks in 1962; 5,025 in 1961; 5,768 in 1960; and 3,708 in 1959.

Gradual buildup, intensification

Each of the four phases in the program represents a gradual buildup in a State's fight against cholera—either by applying new eradication procedures or by intensifying those already used—until the disease is eradicated.

In the first or preparatory phase, State and county eradication committees are organized; information on the disease and the program is distributed to producers; and a system is set up for prompt reporting of all outbreaks of hog cholera. These outbreaks are thoroughly investigated to find the probable source of the infection so that further spread of the disease can be prevented. Reemphasis on garbage cooking and inspection is another important step in this phase.

When a State has all these procedures in effect, it can enter Phase II, "Reduction of Incidence." The objective during this phase is to lower the number of outbreaks of hog cholera. New eradication measures include (1) quarantine of all infected herds and (2) establishment of shipping rules for transporting feeder pigs and breeding stock within the State.

Phase III, "Elimination of Outbreaks," is the first phase in which Federal indemnities can be paid for hogs destroyed because of hog cholera.

A State enters this phase after it has sufficiently reduced the incidence of hog cholera by carrying out all the steps in the first two phases. The primary goal in Phase III is to promptly eliminate the few remaining herds that are infected or have been exposed to the disease. In other words, the State progresses from the intensive control program of the first two phases to an active eradication program, which may include cooperative State-Federal indemnity payments.

Phase IV is a precautionary period for those States that apparently have eliminated hog cholera. If they remain uninfected for at least 1 year—and meet certain other standards—they can be declared hog-cholera free.

The Minute Men are helping to win the war against hog cholera. But they still have a long way to go, ARS officials say. "As the incidence of the disease goes down, apathy becomes our biggest problem," they point out. "Speed, thoroughness and follow-through—as symbolized by the Minute Men—are the keys to the eradication of hog cholera."☆

LEVEL PANS

System of diversions, flat areas nearly double available crop moisture

■ A practical method of conserving moisture has been developed that can help ranchers in the Central High Plains produce adequate feed and forage for their livestock.

Through a system of diversions and level "pans," researchers have made an additional 1.6 to 5.5 inches of moisture available to crops during the growing season. Preliminary results suggest that increased crop yields should repay the cost of constructing the pans in 3 to 5 years.

The additional moisture is that normally wasted as runoff water—not available to crops under conventional fallow or annual cropping. Rainfall available for plant growth in that area may average no more than 5 inches in May through August. And since precipitation is erratic, fallowing usually is required to meet the moisture needs of most crops.

ARS agricultural engineer R. H. Mickelson diverted and spread the runoff on leveled areas or pans planted to livestock feed crops. He is conducting the research at the Central Great Plains Field Station, Akron, Colo., in cooperation with the Colorado Agricultural Experiment Station.

Mickelson leveled and diked five pans, 2.5 to 6.6 acres in size, lying in a broad natural drainageway, 500 to 1,000 feet wide and with slopes ranging from nearly level to 3 percent. Each pan has a runoff-contributing area that is 5 to 55 times its size.

Flumes at the entrance side of each leveled area were used to measure the runoff onto the pan. The depth of water in the pan was controlled by installing flumes on the lower side to allow water in excess of a predetermined depth to flow downslope to the next succeeding pan.

Mickelson grew grain sorghum on the pans and on adjacent plots—some fallowed and some cropped annually—and compared available moisture and yields.

At seeding time, both the pans and the fallowed plots averaged 8 inches of stored soil moisture, whereas plots that were cropped annually to grain sorghum had only 4 inches. The pans were more efficient than fallow, because they stored as much moisture in 7 months as the fallowed area did in 19 months. Scientists estimate that fallow retains only 15 to 25 percent of the moisture it receives.

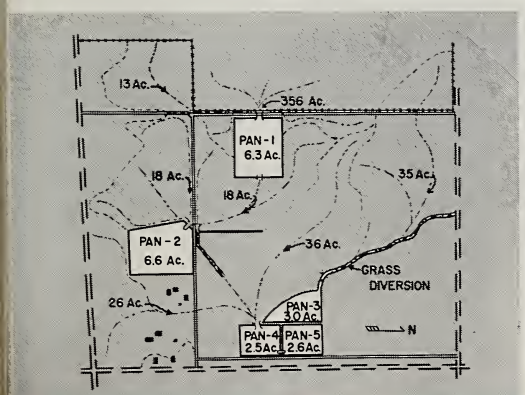
Runoff diverted to the pans or held by them after rains during the growing season added about 1.2 inches of moisture that was lost on fallowed or annually cropped plots.

On an annual basis, the pans thus had an average total of 16.6 inches of soil moisture for crop production—8.3 inches stored at planting time. 7.1 inches of plant-available rainfall received during the growing season, and 1.2 inches of diverted and retained runoff. The fallowed and annually cropped plots averaged 15 and 11 inches of total moisture, respectively.

Data collected at Akron, Garden City, Kans., and Bushland, Tex.. indicate that about 10 inches of growing-season moisture is needed to produce the first bushel of grain sorghum in this area. And each additional inch of moisture increases yield about 10 bushels per acre.

Yields obtained in Mickelson's experiments generally bear out these estimates. Grain sorghum production averaged 41 bushels per acre on the pans in the 3-year experiment. 41 percent more than the fallow plots and 88 percent more than the annually cropped plots yielded.

Research is continuing with other forage crops including some, such as alfalfa, not normally grown without irrigation in the area. Further information is also being obtained on the amount of runoff that can be diverted to the pans under varying rainfall conditions.☆



LEFT—Level pans are arranged so that each has its own contributing area and also (except for pans 1 and 3) gets excess runoff from the pan upslope from it. RIGHT—Pan planted to grain sorghum retains runoff and rainfall from an early-summer rain.

Hogs on this Georgia farm were heavily infested with swine kindeyworms before the "gilt only" method of eradication was started. Four farrowings later, worms had been wiped out.

Study of life cycle of parasite leads to simple way to rid farms of the . . .

SWINE KIDNEYWORM

■ The "gilt only" method of eradicating swine kidneyworms, developed by ARS and Georgia scientists, has been applied successfully on the Guy Connell farm, Nashville, Ga.

The swine kidneyworm, *Stephanurus dentatus,* causes losses of more than $72 million annually in the Southeastern United States. These losses could be cut to nothing within a couple of years if all hog raisers in the area would follow these simple directions:

- Use only gilts for breeding and market them when their pigs are weaned.
- Eliminate all older hogs from the area where hogs are raised.

Producing hogs by this method costs farmers no more than producing them by the conventional method of keeping older, frequently infected sows for breeding. The "gilt only" method, conceived and planned by ARS scientists at the Beltsville Parasitological Laboratory, is based on the fact that the worm parasite may require as long as a year to reach the egg-laying stage. Using only young animals for three or four farrowing seasons—about 2 years eliminated the parasites.

This method, which resulted from many years of basic research on the life cycle of the swine kidneyworms, was proved at the Georgia Coastal Plain Experiment Station, Tifton, a few years ago (AGR. RES., October 1961, p. 11). Then, with the cooperation of farmer Connell, scientists T. B. Stewart, W. N. Smith, and D. J. Jones, all of ARS, and O. M. Hale of Georgia, tested the method on his naturally infested hog farm.

They divided the area of the farm previously used for farrowing into two equal lots. One lot was used for farrowing gilts that had been raised on the infested land. The other lot was used for farrowing gilts that had been raised to farrowing age at a location free of kidneyworms and brought to the farm before farrowing.

Pigs born on the infested areas were kept there until they reached market weight of about 200 pounds. Except for gilts kept for farrowing, all pigs and their dams were slaughtered and examined for kidneyworms.

Seven percent of the pigs born to gilts raised off the farm in an environment that was free of kidneyworms were infected the first season. No kidneyworms were found in the second, third, or fourth farrowings in this lot. In the fifth farrowing, 5 percent of the pigs were infected—this infection was traced to an old sow held in an adjacent lot for a short period.

From an initial infection of 93 percent of pigs born to gilts raised on the infected lot, the incidence of kidneyworms dropped to 50, 18, 6, and 0 percent in succeeding farrowings.

All pigs farrowed by gilts from this farm since the spring of 1963 have been free of kidneyworms.☆

Resists strain A, but not B

Plant breeders' work is never done. The history of the Thaxter baby lima bean variety shows how true this is.

ARS and New York Experiment Station plant breeders developed Thaxter and released it in 1958. They had confidence that it would reduce crop losses caused by downy mildew, which had been destroying a million dollars worth of crops annually.

One of the more serious lima bean diseases, downy mildew affects all young growing parts of the plant; it is particularly damaging to the pods.

Tests last year showed that after 6 years Thaxter was still doing an outstanding job of reducing downy mildew losses. It had largely replaced older varieties of baby limas in New Jersey, Maryland, and Delaware, the main commercial lima bean area of the Middle Atlantic States. More than 3 million pounds of Thaxter seed was planted in this area in 1963.

Why, then, can't plant breeders consider their job done? In 1958—the year Thaxter was released—a new type of downy mildew was found in the Seabrook-Pittsgrove area of New Jersey. Thaxter is not resistant to this new downy mildew, called strain "B." Its resistance is to strain "A."

Strain "B" has not yet caused widespread losses; apparently it has not spread from the Seabrook-Pittsgrove area. But the threat is there, and ARS plant breeders are working at Beltsville, Md., to develop a variety with resistance to both strains.

Under proper growing conditions, Thaxter yields high quality, uniform-sized baby lima beans during the cool, damp downy mildew season that often prevails from mid-August through October along the Middle Atlantic coast.

Early Thorogreen baby lima beans (center) show the effect of downy mildew on a susceptible variety. The healthy plants are the Thaxter variety.

Rotated grazing . . . controls worms?

Rotational grazing, although providing greater net returns than continuous grazing, does not reduce internal parasite infestations in cattle.

A 3-year study by ARS and Georgia Agricultural Experiment Station scientists showed that under existing conditions at the Georgia station, steers rotated from one pasture to another had heavier infestations of stomach and intestinal worms than steers on continuous pastures.

Rotational grazing of steers did permit higher stocking rates, making possible higher gains per acre, greater net returns, less cost per unit of gain.

Continuous grazing produced steers that averaged consistently higher in rate of daily gain and in carcass grades.

The scientists adjusted the number of steers in each group to meet forage conditions. This resulted in an increased number of steers per acre on rotated pastures, which may have been partially responsible for the heavier parasite infestations in these steers, the scientists say. In turn, the greater infestations per steer may have contributed to lower carcass grades and daily weight gains made by the individual steers.

The research was conducted during three consecutive winter grazing seasons on various temporary winter pasture mixtures. A mixture of oats, rye, ryegrass, and crimson clover was superior to other mixtures of pasture grasses, which included rescue and subterranean clover; rescue, fescue, and subterranean clover; rye, oats, and ryegrass; and wheat, ryegrass, and alfalfa.

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AGRISEARCH NOTES

Milk output exceeds feed intake

Talk about efficiency of production! ARS has a cow on test at Beltsville, Md., that produced more calories of milk each day for 20 days than she consumed in feed.

Other high-producing cows have done this in the past but never under the conditions imposed on "Lorna." This Holstein cow is sealed in a plastic chamber where every bit of feed, water, and air she consumes is measured. And where every bit of milk, waste products, and gas she produces is also measured.

It was under these conditions, in the energy-metabolism laboratory at the Agricultural Research Center, that Lorna produced 35,000 calories of milk a day on an intake of 23,000 calories of estimated net energy of feed.

A product of USDA's proved-sire Holstein herd, this cow had one 5-day average of 89 pounds of 5.6 percent butterfat milk per day. This is equal to about 120 pounds of standardized 4 percent milk. During the next three 5-day periods, she averaged 110, 116, and 105 pounds of 4 percent fat-corrected milk per day.

This cow, obviously, is a money-maker. But for W. P. Flatt and the other scientists at the Beltsville Laboratory she means more than that. Lorna is giving them a chance to find out how a high producer uses her feed, plus a lot of stored energy in her body, to produce milk. The knowledge gained from these experiments may lead to dramatic improvements in dairy breeding, feeding, and management.

Lorna has been producing her remarkable record, so far, without losing any body weight. "This will not continue," Flatt said at the end of the fourth 5-day period. "Right now, she is using stored fat and replacing it with water. She cannot continue to do this for very long."

"Lorna" was housed in chamber in background for study of feed intake compared with milk output.

Device tests meat tenderness

A mechanical device that accurately measures the tenderness of meat is a goal of ARS meat technologists working to improve the eating quality of lamb, pork, and beef.

No machine has yet been able to match the ability of human senses fo gaging the subtle differences in me texture. But in limited tests at Belt ville, Md., a research-developed d vice has proved equal to or better tha any mechanical method yet tested.

This new device—called a slice-ter derness evaluator (STE)—first punc tures, then shears, a circular plug fro a slice of cooked meat. The forc needed to penetrate or shear the mea sample is recorded continuously on commercial materials-testing instru ment.

So far, the STE has been used on on typical servings of roast meat, suc as beef rib, pork loin, and leg of lam Because tests can be made at mar locations in the same piece of mea the scientists can determine the tende ness score for the entire sample as we as the relative tenderness of variou areas of the sample.

Quarter-inch-thick slices of beef ri roast for example, were tested at nin sites, and the average of the nine mea urements gave the tenderness score f the entire sample. In beef roast, t tenderest meat is along the outsi away from the bone.

Similar tests of pork roasts show that the tenderest part is at the narro end near the bone. These variatio in meat-tenderness sites may help e plain why tenderness scores by oth instruments or human taste pan often vary widely on a given cut meat.